

in the form of an arch, which extended over 30° of the horizon and to an altitude of 12° .

Mackinaw City, Michigan, 9th: at 7.30 p. m. the clouds disappeared in the northern sky, showing an auroral light of 35° altitude and 90° azimuth; it was of a dull gray color; after 9.45 p. m. occasional streamers shot up to an altitude of 75° ; at 11.45 p. m. the sky became obscured.

Bismarck, Dakota, 9th: a faint aurora was observed at 8.30 p. m., consisting of a pale yellow light, which extended from 135° to 235° azimuth and to 20° altitude; it attained its maximum brilliancy at 10.05 p. m., and disappeared at 10.50 p. m. No dark segment was observed.

Moorhead, Minnesota, 9th: a faint auroral arch was observed at 9.30 p. m., consisting of a white light, of 15° altitude, without streamers.

Fort Yates, Dakota, 9th: a very faint aurora was observed at 10.00 p. m., the sky being partly obscured.

Fort Totten, Dakota, 9th: auroral light was observed in the north at 9 p. m.; it was obscured by clouds at 10 p. m.

Cambridge, Massachusetts: an auroral arch was observed during the evening of the 9th.

Boston, Massachusetts, 9th: an auroral display was observed from 8.30 to 11 p. m.; it extended from 160° to 225° azimuth and to an altitude of 25° ; it was of a pale straw color and was accompanied by "merry dancers."

Albany, New York, 9th: a faint auroral arch of 10° altitude, extending from 150° to 225° azimuth, was observed at 8.40 p. m.; at 11 p. m. the light became diffused and the northwest portion of the dark segment became detached. The light was of a pale straw color, and disappeared at midnight. No streamers appeared. A black cloud extended along the eastern horizon throughout the display.

Escanaba, Michigan, 9th: a bright aurora appeared at 9.08 p. m., consisting of an arch above a bank of clouds; at 10 p. m. a second arch appeared, about 5° above that first observed, with several streamers of bright yellow color. The display continued until early in the morning of the 10th.

Marquette, Michigan, 9th: an aurora was observed at 10 p. m.; the sky being nearly obscured no special features were noted.

Mackinaw City, Michigan, 10th: a faint auroral light was seen from 6.45 to 8.30 p. m.; altitude, 25° ; azimuth, 75° .

Fort Totten, Dakota, 10th: a faint auroral light in the north was seen at 10 p. m., the display ending at 4 a. m. of the 11th. Bangor, Maine, 11th.

Fort Buford, Dakota, 11th: an auroral display began at 10.14 p. m.; when first observed two streamers, of a whitish color, extended to about 40° ; they were nearly stationary, and had a slight reddish hue near the horizon; at 10.40 p. m. the streamers gradually diffused along the horizon to about 8° to 10° altitude and 40° azimuth, between north-northwest and northeast, forming a bank having the appearance of smoke, which continued until 11.10 p. m., after which the aurora gradually disappeared.

Menand Station, New York, 14th: at 9 p. m. three parallel arches, having about 15° altitude and 120° azimuth, extended from north to southeast; the uppermost arch was apparently 3° in width; the lower one exhibited faint lines of light, without motion; the display disappeared at 9.30 p. m.

Cambridge, Massachusetts, 17th: an aurora was suspected at 8.45 p. m.

The following stations report auroras, the observers giving dates only:

6th.—Thornville, Michigan.

7th.—Birmingham, Michigan; Napoleon, Ohio; North Volney and Ithaca, New York; Beverly, New Jersey.

9th.—Webster, Dakota; Cresco, Iowa; Kent's Hill, Maine; Manistique, Michigan; Embarras, Manitowoc, and Prairie du Chien, Wisconsin; Southington, Connecticut; Riley, Illinois.

10th.—Webster, Dakota; Gardiner, Maine; Westborough, Massachusetts.

11th.—Gardiner and Orono, Maine; Burlington, Vermont.

12th.—Atchison, Kansas; Harvard, Nebraska; Yellow Springs, Ohio.

THUNDER-STORMS.

Thunder-storms were reported in the various states and territories, as follows:

Alabama.—Mobile, 5th, 7th; Birmingham, 6th; Greensborough, 6th, 7th, 22d; Montgomery, 6th, 7th, 23d.

Arizona.—Prescott, 3d; Fort Grant, 3d, 4th.

Arkansas.—Fort Smith, 4th, 5th, 17th; Little Rock, 4th, 5th, 6th, 17th, 18th; Mount Ida, 4th, 5th, 26th, 27th; Lead Hill, 5th, 18th.

California.—Sacramento and College City, 10th; Keeler, 16th; San Rafael, 22d.

Florida.—Limona, 7th, 8th; Sanford, 7th, 19th; Tallahassee, 23d; Key West, 28th.

Georgia.—Forsyth, 6th; Augusta, 6th, 7th; Atlanta, 6th, 7th, 23d; Athens, 6th, 22d.

Illinois.—Chicago and Mattoon, 4th; Sandwick, Windsor, and Charleston, 4th, 6th; Springfield, Cairo, Anna, Geneseo, Sycamore, and Bloomington, 6th; Collinsville, 21st, 22d; Bunker Hill, 22d.

Indiana.—Greencastle, 4th, 6th, 18th; Vevay, Jefferson, Sunman, and Spiceland, 6th; Indianapolis and Guilford, 6th, 7th; Fort Wayne, 6th, 7th, 17th; Laconia, 6th, 22d.

Iowa.—Keokuk, Burlington, Dubuque, Davenport, Independence, Monticello, Manchester, Des Moines, Oskaloosa, and Muscatine, 6th; Cedar Rapids, 6th, 8th.

Kansas.—Ninnescah, 3d, 4th; Allison, 3d, 5th, 30th; Independence and Yates Centre, 4th; Ottawa, 4th, 5th, 18th; Fort Scott, 17th; Wyandotte, 21st.

Kentucky.—Louisville, 6th; Richmond, 7th, 22d.

Louisiana.—Grand Coteau, 1st, 5th, 6th; Shreveport, 4th, 5th, 6th; New Orleans, 5th.

Maryland.—Ocean City, 8th.

Michigan.—Thornville, 5th; Grand Haven, 6th; Manistique, 6th, 7th; Marquette and Mackinaw City, 7th; Escanaba, 17th.

Mississippi.—Vicksburg, 6th, 7th.

Missouri.—Pierce City, 3d to 6th; Conception, 5th; Centreville, 17th; Saint Louis, 22d.

New Jersey.—Atlantic City and Dover, 8th.

New York.—Mountainville, 8th.

North Carolina.—Fort Macon and Hatteras, 1st; Smithville, 1st, 7th; New River Inlet, 2d, 8th, 18th, 19th; Charlotte and Lenoir, 6th; Weldon and Kitty Hawk, 8th.

Ohio.—Fostoria, 5th; Cincinnati, Sandusky, North Lewisburg, Wauseon, Yellow Springs, and Napoleon, 6th; Columbus, Cleveland, Toledo, Hiram, and Garrettsville, 7th.

Oregon.—Albany, 3d, 4th, 5th; Bandon, 17th, 24th.

Pennsylvania.—Blooming Grove, 8th.

South Carolina.—Stateburg, 1st, 6th, 7th, 18th; Aiken, 6th, 7th; Spartanburg, 6th, 7th, 8th, 10th, 22d.

Tennessee.—Milan, 5th, 6th, 7th, 18th; Nashville, 6th, 7th; Chattanooga, 6th, 7th, 18th, 22d; Ashwood, 6th, 18th; Knoxville, 6th, 22d.

Texas.—New Ulm, 1st, 3d, 4th, 6th; San Antonio, 3d, 4th; Palestine, 3d, 4th, 5th; Galveston, 3d, 4th, 27th; Cleburne, 4th, 5th, 6th; Rio Grande City, 7th; Brownsville, 27th.

Virginia.—Variety Mills and Wytheville, 6th; Chincoteague and Dale Enterprise, 8th.

Washington Territory.—Pysht, 7th, 8th, 26th; Tatoosh Island, 8th.

West Virginia.—Parkersburg, 6th.

Wisconsin.—Embarras and Manitowoc, 6th; Milwaukee, 6th, 7th.

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos were observed in the various states and territories, as follows:

Arizona.—1st.

Arkansas.—3d, 17th, 26th.

California.—1st to 4th, 6th, 7th, 23d, 26th, 27th.

Colorado.—14th.
Dakota.—2d, 9th, 30th.
Florida.—4th to 7th, 9th, 13th, 21st.
Georgia.—21st.
Illinois.—3d, 11th, 21st.
Indiana.—7th, 12th, 17th.
Iowa.—3d, 4th.
Kansas.—3d, 10th, 14th.
Massachusetts.—12th, 14th, 30th.
Michigan.—6th, 11th, 17th, 19th, 24th.
Minnesota.—9th.
Missouri.—8th.
Nevada.—11th.
New Jersey.—14th, 17th.
New York.—6th, 14th, 21st.
Ohio.—7th, 11th, 12th, 17th, 29th.
Pennsylvania.—12th, 22d, 30th.
South Carolina.—1st, 4th, 11th, 20th.
Tennessee.—3d, 7th, 11th, 12th, 16th, 17th.
Texas.—7th to 10th, 14th, 17th to 20th, 22d, 24th.
Utah.—18th.
Virginia.—5th, 12th.
Wisconsin.—11th, 17th, 24th, 30th.

LUNAR HALOS.

Lunar halos were observed in the various states and territories, as follows:

Alabama.—19th, 21st.
Arizona.—11th, 12th, 15th, 16th, 18th, 22d, 24th, 25th.
Arkansas.—16th, 25th, 26th.
California.—14th, 26th, 27th.
Colorado.—12th, 15th, 16th, 18th.
Connecticut.—12th, 17th.
Dakota.—16th, 18th to 22d, 29th.
District of Columbia.—17th, 18th.
Florida.—13th to 17th, 20th to 24th.
Georgia.—17th.
Idaho.—13th, 15th.
Illinois.—19th, 21st.
Indiana.—10th, 11th, 17th, 18th, 20th, 21st, 26th.
Iowa.—16th, 21st.
Kansas.—7th, 10th, 12th to 16th, 20th, 22d, 26th.
Maine.—15th, 19th, 21st.
Maryland.—17th, 18th, 21st.
Massachusetts.—12th, 14th, 17th, 18th.
Michigan.—16th, 17th, 19th, 27th.
Minnesota.—16th, 19th, 20th, 23d, 24th.
Missouri.—26th, 27th.
Montana.—12th to 16th, 21st.
Nebraska.—14th, 15th, 17th.
Nevada.—15th, 21st.
New Jersey.—9th, 11th, 12th, 16th, 17th, 18th.
New Mexico.—16th, 18th, 19th, 22d, 24th, 25th.
New York.—12th, 15th, 17th, 18th, 20th to 25th, 27th, 28th, 30th.
North Carolina.—16th, 17th, 19th.
Ohio.—17th, 21st.
Oregon.—14th, 22d, 28th.
Pennsylvania.—12th, 15th, 17th.
Rhode Island.—12th, 15th, 17th, 18th.
South Carolina.—15th.
Texas.—10th, 11th, 13th to 25th, 30th.
Utah.—13th, 14th, 15th.
Vermont.—21st.
Virginia.—10th, 11th, 16th, 17th, 18th, 20th, 22d, 24th, 26th.
Washington Territory.—20th, 22d.
Wisconsin.—15th, 19th, 21st, 24th.

The phases of the moon during November were: new moon, 6th, 3.57 p. m.; first quarter, 14th, 4.53 p. m.; full moon, 22d, 4.33 a. m.; last quarter, 28th, 8.51 p. m.; apogee, 12th, 9.06 p. m.; perigee, 24th, 8.30 p. m.

MIRAGE.

Marquette, Nebraska, 9th, 14th, 21st.
 Reidsville, North Carolina, 1st, 10th, 15th, 23d.

MISCELLANEOUS PHENOMENA.

SUN SPOTS.

Prof. David P. Todd, director of the Lawrence Observatory, Amherst, Massachusetts, furnishes the following record of sun spots for November, 1885:

Date— November, 1885.	No. of new.		Disappeared by solar rotation.		Reappeared by solar rotation.		Total No. visible.		Remarks.
	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	Gr'ps	Spots	
3, 11 a. m.							3	12	
4, 2 p. m.	0	0	0	0	0	0	3	7	
6, 12 m.	1	15†			0	0	3	25†	
10, 10 a. m.							4	60†	
11, 4 p. m.	1	2	0	0	0	0	5	50†	
13, 8 a. m.	2	20†					4	35†	
15, 1 p. m.	0	25†	1	5†	0	0	3	60†	
17, 10 a. m.	2	15†	0	0	1	10†	5	70†	
20, 9 a. m.							4	40†	
27, 12 m.	0	0			0	0	0	0	
29, 10 a. m.	1	3	0	0	0	0	1	3	

Faculae were seen at the time of every observation.

† Approximated.

Mr. H. D. Gowey, of North Lewisburg, Champaign county, Ohio, reports having observed sun spots on the following dates: 3d, 7th, 10th, 13th, 16th, 21st, 25th, 29th.

SUNSETS.

The characteristics of the sky, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from one hundred and sixty-two stations show 4,829 observations to have been made, of which four were reported doubtful; of the remainder, 4,825, there were 4,293, or 89.0 per cent., followed by the expected weather.

EARTHQUAKES.

Helena, Montana, 11th: an earthquake shock occurred at 11.58 a. m., of about three seconds' duration.

FOREST AND PRAIRIE FIRES.

Fort Sill, Indian Territory: extensive prairie fires prevailed in this vicinity on the 5th, destroying about six hundred cords of wood.

Dallas, Texas, 23d: reports state that on the 21st about 8,000 acres of excellent grazing land in Mountain Creek Valley were burned over, causing heavy losses to farmers. The damage is estimated at \$20,000.

Wellington, Kansas: from the 5th to 25th prairie fires were numerous. To the southward of this station, in the Indian Territory, large areas from fifty to seventy miles in length were burned over, destroying large quantities of hay, and leaving pastures bare.

Wichita Falls, Texas, 21st: it is reported that prairie fires have burned over an extensive area in the vicinity of Red River Station, causing losses to cattle men, estimated at \$400,000.

Little Rock, Arkansas: from the 15th to the 23d forest fires caused considerable damage in various parts of this state. In Cross county farms were devastated, and people compelled to leave their homes for places of safety.

Forest and prairie fires were also reported from the following stations:

Hatteras, North Carolina, 26th.
 Saint Vincent, Minnesota, 1st, 2d.
 Fort Reno, Indian Territory, 5th, 7th, 9th to 16th, 18th, 19th.
 Fort Supply, Indian Territory, 3d, 5th, 10th, 15th, 19th.
 Fort Sill, Indian Territory, 1st, 3d, 4th, 7th, 9th to 12th.
 Abilene, Texas, 2d.
 Midland, Texas, 15th, 17th.

INSECTS.

Helena, Montana: at 10 p. m. on the 19th a dense swarm of grasshoppers filled the air; they appeared in such numbers